

CLAIMS

What is claimed is

1. An ink for transferring an image from a membrane to a substrate, the ink comprising:

a hydrocarbon solvent having a predetermined evaporation rate;

a synthetic polymeric resin;

a thixotrope for forming a thixotropic network in the ink, the thixotropic network having a thixotropic network magnitude of between 3×10^4 and 6×10^5 dynes/cm²-sec⁻¹ and a thixotropic network strength of at least 35 gm-cm.

2. The ink of claim 1 wherein the ink containing the thixotropic network has a creep viscosity of between 8×10^2 to 9×10^4 poise and a tan ratio δ at least 1.

3. The ink of claim 2 wherein the ink containing thixotropic network has a creep recovery of at least 5% and a static yield stress of between 1 and 50 dynes/cm².

4. The ink of claim 1 wherein the hydrocarbon solvent includes at least one of the following:

an aliphatic hydrocarbon, an aromatic hydrocarbon, a naphthenic hydrocarbon, a chlorinated hydrocarbon, a terpene solvent, an oxygenated solvent, a ketone, an ester, a glycol ether, an acetate, an alcohol, a nitroparaffin, or a furan solvent.

5. The ink of claim 1 wherein the thixotrope includes at least one of the following:

a castor oil derivative, a high molecular weight polyolefin, an attapulgite, a montmorillonite, an organo-clays, a fumed silica, a fibrated mineral, a calcium sulphonate derivative, a polyamide resin, a polyester amide, an alkyds, an oil-modified alkyd, an ionic surfactant agent, or a non-ionic agent.

6. The ink of claim 1 wherein the polymeric resin includes at least one of the following:

a polycarbonate resin, a PVC resin, a polyester resin, an acrylic resin, a vinyl resin, a cellulosic resin, an alkyd resin, a formaldehyde derived resin, an epoxy resin, a polyurethane resin, a silicone resin, a silicate resin, an amino resin, a polyamide resin, a phenolic resin.

7. The ink of claim 1 further comprising:

a pigment dispersed in the ink for opacity or color;
an additive to disperse the pigment, the additive including a surfactant, a dispersant, or mixtures thereof; and
a catalyst to initiate cross-linking between polymer chains in the resin.

8. The ink of claim 7 wherein the pigment includes at least one of the following:

alumina, silica, titanium dioxide, magnesium silicate, barium sulfate, calcium carbonate, aluminum silicate, calcium silicate, aluminum potassium silicate, metallic flakes, yellow iron oxide, chromium green oxide, pearlescent pigment, molybdate orange, cadmium orange, furnace black, channel black, and lamp black, copper phtahocyanine blue, dioxazine violet, quinacridone magenta, azo diarylide yellow, perylene red, Indathone blue, carbazole violet, isoindoline yellow, or pyrazolone orange.

9. The ink of claim 7 wherein the surfactant includes at least one of the following:

metallic soap, sulfonate, phosphate esters, fatty acid ester, fluoroaliphatic polymeric ester, a titanate coupling agent, a zirconate coupling agent, an aluminate coupling agent, an organomodified polysiloxane, a block copolymers of poly(alkylene oxide), Hypermer®, Solsperse®, a hyperdispersant, base neutralized fatty alcohol sulfate, a polyamino-amide phosphate, or carboxylic acid.

10. The ink of claim 7 wherein the catalyst includes at least one of the following:

an isocyanate, a metal drier, an acid, a base, or a peroxide.

11. A membrane image transfer article comprising:

a plastic substrate; and

an ink printed on the substrate, the ink having a thixotropic network, the thixotropic network of the ink having a thixotropic network magnitude of between 3×10^4 and 6×10^5 dynes/cm²-sec⁻¹ and a thixotropic network strength of at least 35.0 gm-cm.

12. The article of claim 11 wherein the ink containing the thixotropic network has a creep viscosity of between 8×10^2 to 9×10^4 poise and a tan ratio δ at least 1.

13. The article of claim 11 wherein the plastic substrate includes at least one of the following:

a polycarbonate, an acrylonitrile-butadiene-styrene copolymer (ABS), a thermoplastic polyolefin (TPO), a nylon, a phenolic, a polyester, a polyurethane, or polyvinyl chloride (PVC).

14. The article of claim 11 wherein the ink comprises:

a hydrocarbon solvent having a predetermined evaporation rate;

a synthetic polymeric resin; and

a thixotrope for forming the thixotropic network in the ink.

15. The article of claim 12 wherein the ink containing the thixotropic network has a creep recovery of at least 5 and a static yield stress of between 1 and 50 dynes/cm².

16. The article of claim 14 wherein the polymeric resin includes at least one of the following:

a polycarbonate resin, a PVC resin, a polyester resin, an acrylic resin, a vinyl resin, a cellulosic resin, an alkyd resin, a formaldehyde derived resin, an epoxy resin, a polyurethane resin, a silicone resin, a silicate resin, an amino resin, a polyamide resin, a phenolic resin.

17. The article of claim 14 wherein the hydrocarbon solvent includes at least one of the following:

an aliphatic hydrocarbon, an aromatic hydrocarbon, a naphthenic hydrocarbon, a chlorinated hydrocarbon, a terpene solvent, an oxygenated solvent, ketones, an ester, a glycol ether, an alcohol, an acetate, a nitroparaffin, a furan solvent.

18. The article of claim 14 wherein the thixotrope includes at least one of the following:

a castor oil derivative, a high density polyolefin, an attapulgite, a montmorillonite, a fumed silica, a fibrated mineral, a calcium sulphonate derivative, a polyamide resin, polyester amide, an alkyds, an oil-modified alkyd, an ionic surfactant agent, or a non-ionic agent.

19. The article of claim 14 wherein the ink further comprises:

a pigment dispersed in the ink for opacity or color;

an additive to disperse the pigment, the additive including a surfactant, a dispersant, or mixtures thereof; and

a catalyst to initiate cross-linking between polymer chains in the resin.

20. The article of claim 19 wherein the pigment includes at least one of the following:

alumina, silica, titanium dioxide, magnesium silicate, barium sulfate, calcium carbonate, aluminum silicate, calcium silicate, aluminum potassium silicate, metallic flakes, yellow iron oxide, chromium green oxide, pearlescent pigments, molybdate orange, cadmium orange, furnace black, channel black, and lamp black, copper phtahocyanine blue, dioxazine violet, quinacridone magenta, azo diarylide yellow,

perylene red, Indathone blue, carbazole violet, isoindoline yellow, or pyrazolone orange.

21. The article of claim 19 wherein the surfactant includes at least one of the following:

a metallic soap, a sulfonate, a phosphate ester, a fatty acid ester, a fluoroaliphatic polymeric ester, a titanate coupling agent, a zirconate coupling agent, an aluminate coupling agent, an organomodified polysiloxane, a block copolymers of poly(alkylene oxide), Hypermer®, Solsperse®, a hyperdispersants, a base neutralized fatty alcohol sulfate, a polyamino-amide phosphate, or carboxylic acid.

22. The article of claim 19 wherein the catalyst includes at least one of the following:

an isocyanate, a metal drier, an acid, a base, or a peroxide.

23. An ink for transferring a membrane image to a substrate, the ink comprising:

- a hydrocarbon solvent;
- a polymeric resin in the hydrocarbon solvent;
- a pigment dispersed therein for opacity or color;
- an additive to disperse in the pigment, the additive including a surfactant, a catalyst, or mixtures thereof; and

a thixotrope for bonding the resin to form a thixotropic network in the ink, the thixotropic network having a thixotropic network magnitude of between 3×10^4 and 6×10^5 dynes/cm²-sec⁻¹ and a thixotropic network strength of at least 35.0 gm-cm.

24. A method of transferring a membrane image to a substrate, the method comprising:

- providing an ink comprising:
- a hydrocarbon solvent having a predetermined evaporation rate;
- a synthetic polymeric resin; and

a thixotrope for forming a thixotropic network in the ink, the thixotropic network having a thixotropic network magnitude of between 3×10^4 and 6×10^5 dynes/cm²-sec⁻¹ and a thixotropic network strength of at least 35.0 gm-cm;

applying a printed decoration through a screen to a membrane;
forming the membrane to the geometry of the surface of an article;
pressing the membrane and the article together in forced contact;
maintaining pressure between the membrane and the article to transfer the membrane image from the membrane to the article.

25. The method of claim 24 further comprising maintaining the membrane and the article in a part fixture.

26. The method of claim 24 wherein the ink containing the thixotropic network has a creep viscosity of between 8×10^2 to 9×10^4 poise and a tan ratio δ at least 1.

27. The method of claim 26 wherein the ink containing thixotropic network has a creep recovery of at least 5% and a static yield stress of between 1 and 50 dynes/cm².

28. The method of claim 24 wherein the hydrocarbon solvent includes at least one of the following:

an aliphatic hydrocarbon, an aromatic hydrocarbon, a naphthenic hydrocarbon, a chlorinated hydrocarbon, a terpene solvent, an oxygenated solvent, a ketone, an ester, a glycol ether, an acetate, an alcohol, a nitroparaffin, or a furan solvent.

29. The method of claim 24 wherein the thixotrope includes at least one of the following:

a castor oil derivative, a high molecular weight polyolefin, an attapulgite, a montmorillonite, an organo-clays, a fumed silica, a fibrated mineral, a calcium

sulphonate derivative, a polyamide resin, a polyester amide, an alkyds, an oil-modified alkyd, an ionic surfactant agent, or a non-ionic agent.

30. The method of claim 24 wherein the polymeric resin includes at least one of the following:

a polycarbonate resin, a PVC resin, a polyester resin, an acrylic resin, a vinyl resin, a cellulosic resin, an alkyd resin, a formaldehyde derived resin, an epoxy resin, a polyurethane resin, a silicone resin, a silicate resin, an amino resin, a polyamide resin, a phenolic resin.

31. The method of claim 24 further comprising:

a pigment dispersed in the ink for opacity or color;
an additive to disperse the pigment, the additive including a surfactant, a dispersant, or mixtures thereof; and
a catalyst to initiate cross-linking between polymer chains in the resin.

32. The method of claim 31 wherein the pigment includes at least one of the following:

alumina, silica, titanium dioxide, magnesium silicate, barium sulfate, calcium carbonate, aluminum silicate, calcium silicate, aluminum potassium silicate, metallic flakes, yellow iron oxide, chromium green oxide, pearlescent pigment, molybdate orange, cadmium orange, furnace black, channel black, and lamp black, copper phtahocyanine blue, dioxazine violet, quinacridone magenta, azo diarylide yellow, perylene red, Indathone blue, carbazole violet, isoindoline yellow, or pyrazolone orange.

33. The method of claim 31 wherein the surfactant includes at least one of the following:

metallic soap, sulfonate, phosphate esters, fatty acid ester, fluoroaliphatic polymeric ester, a titanate coupling agent, a zirconate coupling agent, an aluminate coupling agent, an organomodified polysiloxane, a block copolymers of

poly(alkylene oxide), Hypermer®, Solspperse®, a hyperdispersant, base neutralized fatty alcohol sulfate, a polyamino-amide phosphate, or carboxylic acid.

34. The method of claim 31 wherein the catalyst includes at least one of the following:

an isocyanate, a metal drier, an acid, a base, or a peroxide.